

# Logarithmic Equations

Name: \_\_\_\_\_

Solve for x.

1.  $2^{5x+2} = 2^{3x-4}$

-3

2.  $4^{x-5} = \frac{1}{4}$

4

3.  $3^{x-1} = \sqrt{3^{x+1}}$

3

4.  $(\frac{1}{8})^{x-1} = (\frac{1}{4})^{1-x}$

1  $\frac{1}{2} \cdot 3^{(x-1)} = \frac{1}{2} \cdot 2^{(1-x)}$   
 $3x-3 = 2-2x$   
 $5x = 5$   
 $x = 1$

5.  $\log_x 81 = 2$

9

6.  $\log_3 x = -3$

$\frac{1}{27}$

7.  $\log_4 x = \frac{-5}{2}$

$\frac{1}{32}$

8.  $\log_8 x = \frac{-4}{3}$

$\frac{1}{16}$

$8^{-4/3} = \sqrt[3]{8^{-4}} = 2^{-4} = \frac{1}{16}$

9.  $\log_x 81 = -2$

$\frac{1}{9}$

10.  $\log_x 64 = -3$

$\frac{1}{4}$

11.  $\log_{\sqrt{2}} x = 8$

16

12.  $\log_2(3x-4) = 3$

4

13.  $\log_5 x = 2 \log_5 10$

100

14.  $\ln x = \ln 2 - \ln 5$

$\frac{2}{5}$

15.  $\ln x = \ln e^2 - 1$

$\ln e^2 = 2$   
 $\ln x = 2 - 1$   
 $\ln x = 1$   
 $x = e$

16.  $\ln(x-2) - \ln 2 = \ln 3 - \ln(x-1)$

4

$\ln \frac{x-2}{2} = \ln \frac{3}{x-1}$   
 $\frac{x-2}{2} = \frac{3}{x-1}$   
 $6 = x^2 - 3x + 2$   
 $0 = x^2 - 3x - 4$   
 $(x-4)(x+1)$   
 $x = 4$  (crossed out)  
 $x = -1$  (crossed out)

17.  $e^x = 1$

$\ln 1$

18.  $e^x = 2$

$\ln 2$

19.  $\ln x + \ln(5-x) = \ln 2 + \ln 3$

2 and 3

20.  $\ln x = \sqrt{3}$

$e^{\sqrt{3}}$

21.  $\log x + \log(x-9) = 1$

10

22.  $\log_3(x-4) + \log_3(x+4) = 2$

5

23.  $2^x = 10$

$\frac{\log 10}{\log 2}$  or  $\log_2 10$

24.  $2^x = 3^{x-1}$

$\frac{-\log 3}{\log 2 - \log 3}$  or  $\frac{-\log 3}{\log \frac{2}{3}}$   
 or  $-\log_{\frac{2}{3}} 2$

25.  $3^{x+2} = 5^{x-1}$

$\frac{-2 \log 3 - \log 5}{\log 3 - \log 5}$  or  $\frac{\log 145}{\log 315}$  or  $\log_{315} \frac{1}{45}$

$\log 3^{x+2} = \log 5^{x-1}$

$(x+2) \log 3 = (x-1) \log 5$

$$x \log 3 + 2 \log 3 = x \log 5 - \log 5$$

$$x \log 3 - x \log 5 = -2 \log 3 - \log 5$$

$$x(\log 3 - \log 5) = \log 3^{-2} - \log 5$$

$$x = \frac{\log 3^{-2} - \log 5}{\log 3 - \log 5}$$

$$= \frac{\log 1/45}{\log 3/5}$$